

REMARKS

Claims 1 - 17 are presently pending. In the above-identified Office Action, the Examiner entered a non-final rejection of Claims 1, 3, 7, 8, 12, 13 and 17 under 35 U.S.C. § 103(a) as being unpatentable over Parulski *et al.* Claims 2, 4 - 6, 9 - 11, and 14 - 16 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Parulski *et al.* in view of Adelson.

Applicant notes that Claims 7 - 16 were allowed in the previous Office Action and rejected in the above-identified Office Action. Nonetheless, Applicant is appreciative of the thorough search conducted by the Examiner affording Applicant an opportunity to enter amendments during prosecution which, if effective to overcome the references, may lead to the issue of a stronger patent, presumptively valid with respect to the cited references.

By this Paper, Applicant has amended Claims 1, 7 and 17 and presented new Claims 18 - 20 for consideration. Claim 1 has been amended to include limitations of Claim 2. Claim 7 has been amended to include limitations of Claim 13. Claim 17 has been amended along the lines of Claim 1. For the reasons set forth more fully below, the subject Application is submitted as properly presenting Claims patentable over the prior art. Reconsideration, allowance and passage to issue are respectfully requested.

The present invention addresses the need in the art for an image processing system or technique for extracting a desired image from a scene regardless of the background in the scene. Generally, the inventive system includes an arrangement for providing image data. A memory is provided for storing a first frame of image data consisting of a heterogeneous background scene. Next, the user provides an object as a foreground image into the scene, with the same background. This image is received in plural successive frames, each of which is treated as a second frame of image data in the claims. In accordance with the invention, the second frame is processed to extract the foreground imagery therefrom. That is, the inventive system strips the background imagery from the

second frame without using monochromatic screens or filters. In the best mode, this is effected rapidly and efficiently by a comparison and gating operation as set forth in Claim 1 as amended. Claim 7 sets forth an alternative method for practicing the invention. Claim 17 is a method claim drawn along the lines of Claim 1.

Claim 1, as amended, reads as follows:

1. A system for extracting an image comprising:
 first means for providing image data;
 second means responsive to said first means for storing a first frame of image data consisting of a heterogeneous background scene;
 third means responsive to said first means for providing a second frame of image data consisting of a second scene having said background scene at least partially obscured by a foreground object; and
 fourth means responsive to said second and third means for processing said second frame to extract an image of said object independent of said background scene, said fourth means including:
 means for comparing picture elements of said second frame to corresponding picture elements in said first frame; and
 means for outputting said corresponding picture elements in said second frame if the result of the comparison is a predetermined value. (Emphasis added.)

None of the references, including those cited but not applied, taken alone or in combination teaches, discloses or suggests the invention as presently claimed. That is, none of the references teaches a system for extracting an image of an object, from a heterogeneous background scene, having means for comparing picture elements (pixels) of a current frame to those of a stored frame and selectively outputting picture elements in the current frame based on the result of the comparison.

In the above-identified Office Action, the Examiner rejected Claim 2 as being unpatentable over the combined teachings of Parulski *et al.* and Adelson. The Examiner suggested that in columns 6, lines 8 -14, Adelson's teaching is such that it would be obvious to include a comparing means for comparing picture elements to decide whether the desired picture will be output.

However, there is nothing in either reference to support this conclusion. That is, Parulski *et al.* clearly provide no teaching for pixel-by-pixel comparison of two frames and the selective gating of the output of the current frame in response to the result of the comparison process.

The Examiner suggests that this teaching is provided by Adelson in columns 6, lines 8 - 14. However, this passage merely reads as follows:

For the moment, it is assumed that there is no motion-blur or focus-blur near the edge of the baseball. Accordingly, points on the attenuation map corresponding to the position of the baseball had a value of zero, corresponding to full attenuation, i.e., elimination of the image of the underlying layers(s) at that location, and unity, indicating no attenuation of the underlying layer(s), at all other points.

Where in this passage (or elsewhere in the reference) is a teaching of pixel-by-pixel comparison of two frames and the selective gating of the output of the current frame in response to the result of the comparison process ? Clarification from the Examiner is requested.

Further, there is nothing in the teaching of either reference to support a combination of the two references and, in any event, the combined teachings of the two references still falls far short of teaching the invention as presently claimed. That is, the combined teaching stills fails to teach a pixel-by-pixel comparison of two frames and the selective gating of the output of the current frame in response to the result of the comparison process. Accordingly, Applicant respectfully requests reconsideration of the rejection of Claim 1 and the claims dependent thereon.

Claims 7 and 13 were rejected as being unpatentable over Parulski *et al.* with respect to claim 13, the Examiner suggested that in columns 5, lines 28 - 67 Parulski *et al.* differentiation of a filtered image frame. However, the suggested passage of Parulski *et al.* provides no such teaching. Indeed, there is no mention of 'differentiation' at all. Perhaps the Examiner is confusing 'differencing' with 'differentiation'. 'Differencing' has to do with a subtraction process by which two frames are subtracted from another in accordance with the teachings of Parulski *et al.* The term 'differentiation' on the other hand, has to do with a detection of a change in a value of a pixel relative to one or more adjacent pixels over a single frame. In accordance with the present teachings, 'differencing' is performed between two or more frames, and 'differentiation' is performed over the differenced frame.

Differentiation highlights edges. Note that in lines 39 through 44 of columns 5, Parulski *et al.* teach elimination of edges. Thus, the teachings of Parulski *et al.* and the

other references, clearly do not anticipate the teaching of Claims 7 and the Claims dependent thereon.

For the reasons set forth above with respect to Claim 1, Claim 17 should be allowable as well. Thus all of the claims presently pending should be allowable. Reconsideration, allowance and passage to issue are therefore respectfully requested.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE**IN THE SPECIFICATION:**

Paragraph beginning at page 6, line 19, has been amended as follows:

Fig. 2 is a diagram which depicts a preferred embodiment of an imaging system constructed in accordance with the teachings of the present invention. In the preferred embodiment, the system 30 includes the digital camera and background image memory 14 of Fig. 1. However, in the preferred embodiment, the image processor 20 is implemented with a comparator 40 ~~comparator40~~, AND gate 42 and microcontroller 50. The background image is stored as per Fig. 1. However, in the preferred embodiment, the comparator scans the dynamic live video image and compares it to the stored background image on a pixel by pixel basis. If there is a match, the comparator 40 outputs a logical one, which is inverted at the input to the AND gate 42. If there is no match, the comparator outputs a logical zero, which turns on the AND gate 42. This enables the current pixel of live video data to be passed by the AND gate as the output of the image processor 20. Those skilled in the art will appreciate that system would be clocked for proper timing and latches and other delay elements may be required for this purpose as well. These elements may be provided by one of ordinary skill in the art as needed for a given application without undue experimentation. A controller 50 controls each element of the circuit along with the clock timing in response to user input or software control.

IN THE CLAIMS:

Please cancel Claims 2 and 13.

Claim 1 has been amended as follows:

1. (Twice Amended) A system for extracting an image comprising:

first means for providing image data;

second means responsive to said first means for storing a first frame of image data consisting of a heterogeneous background scene;

third means responsive to said first means for providing a second frame of image data consisting of a second scene having said background scene at least partially obscured by a foreground object; and

fourth means responsive to said second and third means for processing said second frame to extract an image of said object independent of said background scene, said fourth means including:

means for comparing picture elements of said second frame to corresponding picture elements in said first frame; and
means for outputting said corresponding picture elements in said second frame if the result of the comparison is a predetermined value.

Claim 7 has been amended as follows:

7. (Twice Amended) A system for extracting images comprising:

first means for providing image data;

second means responsive to said first means for storing a first frame of image data consisting of a heterogeneous background scene;

third means responsive to said first means for providing a second frame of image data consisting of a second scene having said background scene at least partially obscured by a foreground object;

fourth means for subtracting said first frame from said second frame and providing a difference frame;

fifth means for processing said difference frame to provide a template, said fifth means including means for differentiating said filtered image to provide said template; and

sixth means for multiplying said second frame by said template to extract an image consisting essentially of said foreground object.

Claim 17 has been amended as follows:

17. An image processing method for extracting an image, said method including the steps of:

storing a first frame of image data consisting of a heterogeneous background scene; providing a second frame of image data consisting of a second scene having said background scene at least partially obscured by a foreground object; and

processing said second frame to extract an image of said object independent of said background scene, said processing step further including the steps of:

comparing picture elements of said second frame to corresponding picture elements in said first frame and

outputting said corresponding picture elements in said second frame if the result of the comparison is a predetermined value.

Claim 18 has been added as follows:

-- 18. The invention of Claim 1 wherein said means for outputting said corresponding picture elements includes means for logically gating picture elements in said current frame in response to the output of said means for comparing. --

Claim 19 has been added as follows:

-- 19. The invention of Claim 18 wherein said means for logically gating includes means for logically ANDing corresponding picture elements in said second frame with the output of said means for comparing. --

Claim 20 has been added as follows:

-- 20. The invention of Claim 19 wherein said means for logically gating includes means for logically ANDing corresponding picture elements in said second frame with an inverted output of said means for comparing. --